REMARKS

In view of the above amendments and the following remarks, reconsideration of the rejections contained in the Office Action of June 23, 2009 is respectfully requested.

By this Amendment, claim 11 has been amended. Thus, claims 1-28 are currently pending in the application. No new matter has been added by these amendments.

On pages 2-6 of the Office Action, the Examiner rejected claims 1, 2, 9-11, 23 and 26 under 35 U.S.C. § 103(a) as being unpatentable over Hitoshi (JP 2002-226871) in view of Egan (U.S. 3,647,681). For the reasons discussed below, it is respectfully submitted that these claims, including independent claims 1, 2 and 11, are clearly patentable over the applied prior art.

Independent claim 1 recites a method of producing sub-critical water decomposition products. The method of claim 1 includes continuously supplying material to be processed into a reactor through an inlet provided for the reactor, whose interior is kept at a sub-critical condition for water. The method of claim 1 also includes *continuously taking out a liquid containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, to adjust residence time of the liquid containing the decomposition product in the reactor.*

Hitoshi discloses a gasification reactor which decomposes plastics at high temperature and high pressure. However, as acknowledged by the Examiner on page 2 of the Office Action, Hitoshi does not disclose a method which includes continuously taking out a liquid containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, as required by independent claim 1, because Fig. 1 of Hitoshi only discloses the reactor 1 as having a single outlet.

In this regard, the Examiner cites Egan as disclosing an example of fractionating, in which a chemical reactor having multiple outlets is used. Further, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to provide multiple outlets on the reactor of Hitoshi in order to use fractionating to remove selected decomposition products.

However, it is first noted that Hitoshi does not disclose a method which includes *continuously taking out a liquid* containing a decomposition product *to adjust residence time of the liquid containing the decomposition product in the reactor*, as required by independent claim 1. In this regard, the Examiner cites paragraphs [0025] and [0026] as disclosing continuously taking out a liquid to adjust residence time of the liquid containing the decompositions product.

However, it is noted that paragraphs [0025] and [0026] do not disclose or suggest continuously taking out a liquid containing a decomposition product to adjust residence time of the liquid containing the decomposition product in the reactor. Rather, paragraph [0024] of Hitoshi discloses that the holding time is controlled by controlling the **speed** at which the high-pressure, high-temperature water is **supplied** to the reactor.

Further, Egan also does not disclose or suggest continuously taking out a liquid containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, to adjust residence time of the liquid containing the decomposition product in the reactor, as required by independent claim 1.

Accordingly, as none of the Hitoshi and Egan references discloses a method which includes continuously taking out a liquid containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, to adjust residence time of the liquid containing the decomposition product in the reactor, as required by independent claim 1, it is respectfully submitted that the combination of the Hitoshi and Egan references does not disclose or suggest the method of independent claim 1.

Independent claim 2 recites a method of producing sub-critical water decomposition products. The method of claim 2 includes continuously supplying material to be processed into a reactor through an inlet provided for the reactor, whose interior is kept at a sub-critical condition for water, and *continuously taking out a liquid containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, to form desired steady concentration profiles of the decomposition product in the reactor*. The method of claim 2 also includes taking out the desired decomposition product through at least one of the outlets, the at least one of the outlets being provided at a position where the concentration of the desired decomposition product is high.

As discussed above, Hitoshi discloses a gasification reactor which decomposes plastics at high temperature and high pressure, but does not disclose a method which includes continuously taking out a liquid containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, as required by independent claim 2, because Fig. 1 of Hitoshi only discloses the reactor 1 as having

a single outlet.

In this regard, the Examiner cites Egan as disclosing an example of fractionating, in which a chemical reactor having multiple outlets is used. Further, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to provide multiple outlets on the reactor of Hitoshi in order to use fractionating to remove selected decomposition products.

However, it is noted that Hitoshi does not disclose continuously taking out a liquid containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, to form desired steady concentration profiles of the decomposition product in the reactor, as required by independent claim 2. In particular, the Examiner cites paragraphs [0025] and [0026] of Hitoshi as disclosing continuously taking out a liquid containing a decomposition product through an outlet, but does not indicate how the prior art discloses continuously taking out a liquid to form desired steady concentration profiles of the decomposition product in the reactor. In this regard, it is noted that paragraph [0026] of Hitoshi merely discloses that the liquid is discharged from an outlet, and does not disclose or suggest continuously taking out a liquid containing a decomposition product to form desired steady concentration profiles of the decomposition product in the reactor, as required by independent claim 2.

Further, Egan also does not disclose or suggest continuously taking out a liquid containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, to form desired steady concentration profiles of the decomposition product in the reactor, as required by independent claim 2.

Accordingly, as none of the Hitoshi and Egan references discloses a method which includes continuously taking out a liquid containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, to form desired steady concentration profiles of the decomposition product in the reactor, as required by independent claim 2, it is respectfully submitted that the combination of the Hitoshi and Egan references does not disclose or suggest the method of independent claim 2.

Amended independent claim 11 recites an apparatus for sub-critical water decomposition treatment, comprising a reactor configured to decompose material to be processed using sub-

critical water, heating means for heating a mixture composed of water and the to be processed material to form and keep sub-critical conditions for water, and compressing means for compressing the mixture. Further, claim 11 recites introducing means for introducing the material to be processed into the reactor, an inlet through which the material to be processed is to be introduced into the reactor, and *a plurality of outlets for letting out a mixture of a decomposition product and water from the reactor, wherein the outlets are provided at respective positions which are different from one another in a flow direction of the sub-critical water*, and which are different from a position at which the inlet is provided.

Hitoshi discloses a gasification reactor which decomposes plastics at high temperature and high pressure. However, as acknowledged by the Examiner on page 9 of the Office Action, Hitoshi does not disclose a plurality of outlets, as required by independent claim 11.

In this regard, the Examiner cites Egan as disclosing an example of fractionating, in which a chemical reactor having multiple outlets is used. Further, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to provide multiple outlets on the reactor of Hitoshi in order to use fractionating to remove selected decomposition products.

However, Egan does not disclose *a plurality of outlets for letting out a mixture of a decomposition product and water from the reactor, wherein the outlets are provided at respective positions which are different from one another in a flow direction of the sub-critical water*, as required by independent claim 11. Rather, Egan only discloses that effluent passes through line 4 into separation zone 5, and that liquid fractions are withdrawn through lines 7-10 (while line 6 is only disclosed as an outlet for gas). However, the outlets of lines 7-10 of Egan are all in the same position in the flow direction of the liquids (*i.e.*, left to right in Fig. 1), and therefore Egan does not disclose a plurality of outlets for letting out a mixture of a decomposition product and water, wherein the outlets are provided at respective positions which are different from one another in a flow direction of the sub-critical water, as required by independent claim 11.

Accordingly, as none of the Hitoshi and Egan references discloses a plurality of outlets provided at respective positions which are different from one another in a flow direction of the sub-critical water, as required by independent claim 11, it is respectfully submitted that the combination of the Hitoshi and Egan references does not disclose or suggest the apparatus of independent claim 11.

Therefore, for the reasons presented above, it is believed apparent that the present

invention as recited in independent claims 1, 2 and 11 is not disclosed or suggested by the Hitoshi reference and the Egan reference taken either individually or in combination. Accordingly, a person having ordinary skill in the art would clearly not have modified the Hitoshi reference in view of the Egan reference in such a manner as to result in or otherwise render obvious the present invention of independent claims 1, 2 and 11.

Further, it is respectfully submitted that claims 9, 10, 23 and 26 are patentable over the applied prior art, at least by virtue of their dependency from independent claims 1 and 2.

On pages 6-9 of the Office Action, the Examiner rejected claims 3-8, 24, 25, 27 and 28 under 35 U.S.C. § 103(a) as being unpatentable over Pilz et al. (U.S. 2002/0113024) in view of Egan. For the reasons discussed below, it is respectfully submitted that these claims, including independent claims 3 and 4, are clearly patentable over the applied prior art.

Independent claim 3 recites a method of producing sub-critical water decomposition products. The method of claim 3 includes continuously supplying material to be processed that contains solid matter having a slow decomposition rate with sub-critical water and a different specific gravity from that of the sub-critical water, into a vertical-type reactor whose interior is kept at sub-critical conditions for water, through an inlet provided for the reactor. The method of claim 3 also includes selecting an outlet from which a liquid containing a decomposition product is let out and adjusting an outlet amount thereof, to make a steady flow in the sub-critical water in a steady state with a plurality of outlets provided at a position different in height from where the inlet is provided for the reactor, with the steady flow flowing in an opposite direction to a direction in which the solid matter sinks or floats up and being slower than a sinking velocity or floating velocity of the solid matter.

The method of claim 3 also includes *forming in the steady flow, in the following order from upstream of the flow, at least a fluidized bed* in which the solid matter is decomposed into fine particles by the sub-critical water and the fine particles fluidize in the flow, *and a sub-critical water dissolution part* in which the material to be processed is turned into further finer particles or completely turned into a soluble material to flow with the sub-critical water, and *further forming a fixed bed in which solid matter stays in a fixed location even with the flow, with the fixed bed being formed upstream of the fluidized bed.* Claim 3 also recites taking out the liquid containing a desired decomposition product from the sub-critical water dissolution part

from the reactor, using at least one of the outlets.

Pilz discloses a method for supercritical wet oxidation which, as shown in Fig. 5, includes supplying supercritical water to a vessel 2 through a conduit 4, and introducing solids into the vessel 2 through an inlet 22. Pilz also discloses that the vessel 2 includes an outlet 24 for the removal of solids, a vertical separation wall 26 and a horizontal separation wall 28.

However, as acknowledged by the Examiner on page 7 of the Office Action, Pilz does not disclose a method which includes selecting an outlet from which a liquid containing a decomposition product is let out and adjusting an outlet amount thereof, to make a steady flow in the sub-critical water in a steady state with a plurality of outlets provided at a position different in height from where the inlet is provided for the reactor, as required by independent claim 3.

In this regard, the Examiner cites Egan as disclosing an example of fractionating, in which a chemical reactor having multiple outlets is used. Further, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to provide multiple outlets on the reactor of Pilz in order to use fractionating to remove selected decomposition products. (It is noted that page 7 of the Office Action indicates that it would have been obvious to combine the multiple outlets on the reactor of Hitoshi. However, as the Hitoshi reference is not mentioned in the rejection of claim 3, it is presumed that the Examiner intended to state the "reactor of Pilz").

However, it is noted that Pilz does not disclose *forming a sub-critical water dissolution part downstream of the fluidized bed, and forming a fixed bed upstream of the fluidized bed*, as required by independent claim 3. In particular, Pilz discloses a turbulence layer 30 in which particles are fluidized (paragraphs [0051] and [0052]), and thus the Examiner appears to take the position that the turbulence layer 30 corresponds to the fluidized bed of claim 3. In this regard, Pilz does not disclose forming a sub-critical water dissolution part downstream of the fluidized bed, as required by independent claim 3.

Further, Pilz does not disclose forming a fixed bed upstream of the fluidized bed, as required by independent claim 3. In this regard, the Examiner notes on page 7 of the Office Action that paragraph [0045] of Pilz "recognizes sedimentation," and thus concludes that Pilz discloses a fixed bed. However, Pilz discloses that sedimentation is recognized as being problematic, and that in place of a fixed bed, the turbulence bed is formed at a flow speed sufficient to keep the solid particles in suspension (see paragraphs [0008], [0009] and [0045]). Therefore, Pilz does not disclose forming a fixed bed upstream of the fluidized bed, as required

by independent claim 3, as Pilz explicitly teaches that the turbulence bed is formed in place of a fixed bed.

Further, Egan also does not disclose a method which includes *forming a sub-critical water dissolution part downstream of the fluidized bed, and forming a fixed bed upstream of the fluidized bed*, as required by independent claim 3.

Accordingly, as none of the Pilz and Egan references discloses a method which includes forming a sub-critical water dissolution part downstream of the fluidized bed, and forming a fixed bed upstream of the fluidized bed, as required by independent claim 3, it is respectfully submitted that the combination of the Pilz and Egan references does not disclose or suggest the method of independent claim 3.

Independent claim 4 recites a method of producing sub-critical water decomposition products. The method of claim 4 includes supplying a mixture including an object containing solid matter and subcritical water into a reaction container through a same inlet and causing the mixture to flow in sub-critical water in a steady state in an opposite direction to a direction in which the solid matter flows. The method of claim 4 also includes *forming in the flow, in the following order from upstream of the flow, at least a fluidized bed* in which the solid matter is decomposed into fine particles by the sub-critical water and the fine particles fluidize in the flow, *and a sub-critical water dissolution part* in which the material to be processed is turned into further finer particles or completely turned into a soluble material to flow with the sub-critical water. Further, the method of claim 4 includes further forming, depending on a type of the material to be processed, *a fixed bed in which solid matter stays in a fixed location even with the flow, the fixed bed being formed upstream of the fluidized bed*, and adjusting a distance through which the sub-critical water dissolution part flows to vary a residence time of the solid matter and a residence time of the sub-critical water from each other and to adjust a degree of decomposition of the components of the material to be processed that have been made soluble to the sub-critical water, whereby a target decomposition treatment product is obtained.

As indicated above, Pilz discloses a method for supercritical wet oxidation which, as shown in Fig. 5, includes supplying supercritical water to a vessel 2 through a conduit 4, and introducing solids into the vessel 2 through an inlet 22. However, Pilz does not disclose adjusting a distance through which the sub-critical water dissolution part flows to vary a

residence time of the solid matter and a residence time of the sub-critical water from each other, as required by independent claim 4.

In this regard, the Examiner cites Egan as disclosing an example of fractionating, in which a chemical reactor having multiple outlets is used. Further, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to provide multiple outlets on the reactor of Pilz in order to use fractionating to remove selected decomposition products.

However, it is noted that Pilz does not disclose *forming a sub-critical water dissolution part downstream of the fluidized bed, and forming a fixed bed upstream of the fluidized bed*, as required by independent claim 4. As discussed above, Pilz discloses a turbulence layer 30 in which particles are fluidized (paragraphs [0051] and [0052]), and thus the Examiner appears to take the position that the turbulence layer 30 corresponds to the fluidized bed of claim 4. In this regard, Pilz does not disclose forming a sub-critical water dissolution part downstream of the fluidized bed, as required by independent claim 4.

Further, Pilz does not disclose forming a fixed bed upstream of the fluidized bed, as required by independent claim 4. In this regard, the Examiner notes on page 8 of the Office Action that paragraph [0045] of Pilz "recognizes sedimentation," and thus concludes that Pilz discloses a fixed bed. However, Pilz discloses that sedimentation is recognized as being problematic, and that in place of a fixed bed, the turbulence bed is formed at a flow speed sufficient to keep the solid particles in suspension (see paragraphs [0008], [0009] and [0045]). Therefore, Pilz does not disclose forming a fixed bed upstream of the fluidized bed, as required by independent claim 4, as Pilz explicitly teaches that the turbulence bed is formed in place of a fixed bed.

Further, Egan also does not disclose a method which includes *forming a sub-critical water dissolution part downstream of the fluidized bed, and forming a fixed bed upstream of the fluidized bed*, as required by independent claim 4.

Accordingly, as none of the Pilz and Egan references discloses a method which includes forming a sub-critical water dissolution part downstream of the fluidized bed, and forming a fixed bed upstream of the fluidized bed, as required by independent claim 4, it is respectfully submitted that the combination of the Pilz and Egan references does not disclose or suggest the method of independent claim 4.

Therefore, for the reasons presented above, it is believed apparent that the present

invention as recited in independent claims 3 and 4 is not disclosed or suggested by the Pilz reference and the Egan reference taken either individually or in combination. Accordingly, a person having ordinary skill in the art would clearly not have modified the Pilz reference in view of the Egan reference in such a manner as to result in or otherwise render obvious the present invention of independent claims 3 and 4.

Further, it is respectfully submitted that claims 5-8, 24, 25, 27 and 28 are patentable over the applied prior art, at least by virtue of their dependency from independent claims 3 and 4.

On pages 9-14 of the Office Action, the Examiner rejected claims 12, 13 and 15-22 under 35 U.S.C. § 103(a) as being unpatentable over Pilz in view of Egan and Hitoshi. For the reasons discussed below, it is respectfully submitted that these claims, including independent claim 12, are clearly patentable over the applied prior art.

Independent claim 12 recites an apparatus for sub-critical water decomposition treatment, which includes a vertical-type reactor configured to decompose material to be processed with sub-critical water, heating means for heating a mixture of water and the material to be processed and compressing means for compressing the mixture, so as to form and keep a sub-critical condition for water, and introducing means for introducing the material to be processed into the reactor. Further, claim 12 recites an inlet through which the material to be processed is to be introduced into the reactor, and an outlet for letting out a mixture of water and a decomposition product from the reactor.

In addition, claim 12 recites that the reactor is arranged substantially vertically, the inlet is provided for at least one of a top end portion or a bottom end portion of the reactor, and that the introduced mixture of the material to be processed and the sub-critical water is caused to flow, in the sub-critical water in a steady state, in an opposite direction to a direction in which the solid matter travels, *so as to form in the flow, in the following order from upstream of the flow, at least a fluidized bed* in which the solid matter is decomposed into fine particles with the sub-critical water and the fine particles fluidize in the flow, *and a sub-critical water dissolution part* in which the material to be processed is turned into further finer particles or completely into a soluble material to flow with the sub-critical water, *and to further form, depending on the material to be processed, a fixed bed in which solid matter stays in a fixed position even with the flow, the fixed bed being formed upstream of the fluidized bed.* Further, claim 12 recites that a

position of the outlet is adjustable so as to let out the sub-critical water dissolution part and adjust a distance through which the sub-critical water dissolution part flows.

Pilz discloses a method for supercritical wet oxidation which, as shown in Fig. 5, includes supplying supercritical water to a vessel 2 through a conduit 4, and introducing solids into the vessel 2 through an inlet 22. However, as indicated by the Examiner on page 11 of the Office Action, Pilz does not disclose a heating and pressurizing means, and does not disclose that a position of the outlet is adjustable so as to let out the sub-critical water dissolution part and adjust a distance through which the sub-critical water dissolution part flows, as required by independent claim 12.

On page 11 of the Office Action, the Examiner cites Hitoshi as disclosing a heating and pressurizing means. However, as indicated above, Hitoshi only discloses the reactor 1 as having a single outlet, and does not disclose that *a position of the outlet is adjustable so as to let out the sub-critical water dissolution part and adjust a distance through which the sub-critical water dissolution part flows*, as required by independent claim 12.

Further, on page 11 of the Office Action, the Examiner cites Egan as disclosing as disclosing an example of fractionating, in which a chemical reactor having multiple outlets is used. Further, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to provide multiple outlets on the reactor of Pilz in order to use fractionating to remove selected decomposition products.

However, it is noted that Pilz does not disclose a reactor in which the sub-critical water is caused to flow in an opposite direction to a direction in which the solid matter travels *so as to form a sub-critical water dissolution part downstream of the fluidized bed, and so as to form a fixed bed upstream of the fluidized bed*, as required by independent claim 12. As discussed above, Pilz discloses a turbulence layer 30 in which particles are fluidized, but does not disclose a reactor in which the sub-critical water is caused to flow in an opposite direction to a direction in which the solid matter travels so as to form a sub-critical water dissolution part downstream of the fluidized bed, as required by independent claim 12.

Further, Pilz does not disclose a fixed bed formed upstream of the fluidized bed, as required by independent claim 12. Rather, as discussed above, Pilz discloses that sedimentation is recognized as being problematic, and that in place of a fixed bed, the turbulence bed is formed at a flow speed sufficient to keep the solid particles in suspension (see paragraphs [0008], [0009]

and [0045]). Therefore, Pilz does not disclose a reactor in which the sub-critical water is caused to flow in an opposite direction to a direction in which the solid matter travels so as to form a fixed bed upstream of the fluidized bed, as required by independent claim 12, as Pilz explicitly teaches that the turbulence bed is formed in place of a fixed bed.

Further, it is noted that the Hitoshi and Egan references also do not disclose a reactor in which the sub-critical water is caused to flow in an opposite direction to a direction in which the solid matter travels *so as to form a sub-critical water dissolution part downstream of the fluidized bed, and so as to form a fixed bed upstream of the fluidized bed*, as required by independent claim 12.

Accordingly, as none of the Pilz, Hitoshi and Egan references discloses a reactor in which the sub-critical water is caused to flow in an opposite direction to a direction in which the solid matter travels so as to form a sub-critical water dissolution part downstream of the fluidized bed, and so as to form a fixed bed upstream of the fluidized bed, as required by independent claim 12, it is respectfully submitted that the combination of the Pilz, Hitoshi and Egan references does not disclose or suggest the reactor of independent claim 12.

Therefore, for the reasons presented above, it is believed apparent that the present invention as recited in independent claim 12 is not disclosed or suggested by the Pilz reference, the Hitoshi reference and the Egan reference taken either individually or in combination. Accordingly, a person having ordinary skill in the art would clearly not have modified the Pilz reference in view of the Hitoshi reference and the Egan reference in such a manner as to result in or otherwise render obvious the present invention of independent claim 12.

Further, it is respectfully submitted that claims 13 and 15-22 are patentable over the applied prior art, at least by virtue of their dependency from independent claim 12.

On pages 14-15 of the Office Action, the Examiner rejected claim 14 under 35 U.S.C. § 103(a) as being unpatentable over Pilz, Egan and Hitoshi, and further in view of Geissbeuhler et al. (US 5,797,989). However, it is noted that Geissbeuhler does not cure the defects of the Pilz, Egan and Hitoshi references, as discussed above, and that claim 14 is patentable over the applied prior art at least by virtue of its dependency from independent claim 12.

Therefore, it is respectfully submitted that independent claims 1-4, 11 and 12, as well as claims 5-10 and 13-28 which depend therefrom, are clearly allowable over the prior art of record.

In view of the foregoing remarks, it is respectfully submitted that the present application is clearly in condition for allowance. An early notice to that effect is respectfully solicited.

If, after reviewing this response, the Examiner feels there are any issues remaining which must be resolved before the application can be passed to issue, the Examiner is respectfully requested to contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

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